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## A Meta-Analysis on the Health Risk of Forest-Ecosystem Degradation

Jacob Islary\*

**Abstract:** Human beings depend on the forest ecosystem besides other needs for health care and wellbeing. However the structural changes that have taken place in the past centuries especially in the forest ecosystem due to human interventions guided by capitalistic and anthropocentric approach to development have negatively affected quality of life - including health; not only by depletion and loss of medicinal plants and organism but also loss of diet and nutrition from the ecosystem, loss of indigenous health knowledge and overall ecological imbalance which is posing great risk to safety and security of human. The study attempts to analyse the effects of forest ecosystem degradation on human health from literature in the areas of environmental health, ecology and environment study. The study though articulates the relationship between forest ecosystem degradation and negative health effects, however has not been able to statistically establish this relationship as there are gaps within the existing literature and methodology and suggests for a development and application of a methodology of study to capture and fill this gap and contribute towards formulation and planning of policies and programmes that address this concern of relationship between forest ecosystem degradation and human health.

**Key Terms:** health, forest structural changes, medicinal plants, indigenous health knowledge.

\*Jacob Islary is an Assistant Professor of Social Work, Assam Don Bosco University, Guwahati and can be contacted at [jislary@gmail.com](mailto:jislary@gmail.com)

### Introduction

Hippocrates around 400 BCE wrote about the natural environment as being an important determinant of human health in his work titled *On Airs, Waters and Places*, a view if not denied acknowledged only till recently. The study of environmental health in the past century has been focusing on the aspect of quantitative exposure to toxins influenced largely by the risk of toxification of the natural environment caused by industrialization accompanied by disasters, accidents, spills and leakages in various industries including transportation; while the structural changes of the natural environment caused by unscrupulous exploitation of the environment often led by capitalistic and anthropocentric approach to 'development' has been neglected and if not – considered to be of little interest. The exploitation of the natural environment is expected to increase with the ever increasing global population which has crossed record high of 7 billion people.

Human beings though nomadic by origin with passage of time began to adopt sedentary life style. And though evidence show that 'the cradle of ancient human civilizations was not a primeval forests' as there were

more civilizations in open alluvial plains and river basins as against 'only few traces of prehistoric man... in densely forested regions' (Zon 1920: 139–140) there is no denial that forest served the needs for food, recreational activities, shelter and health care of the first human beings, where their lifestyle was that of hunter-gatherers. Authors like Sahlins (1972) even terms this life style of hunter-gatherers as 'original affluent society' as they enjoyed more leisure time, spent less energy in production of food and lived a higher quality of life than the sedentary farming society that had to toil in the fields.

This study focuses on the importance of forest-ecosystem and its effects on human health. The study reviews literature and analyses secondary data including online resource centres related to environment, forestry and health.

### Forest ecosystem and human activity

Forest ecosystem refers to an area dominated by tree cover that which sustains a community of living organisms with its complex web of relationships along with all non-living environmental factors. Forests

ecosystems control climate, purify air, and serve as reservoir of flora and fauna. Human beings like other living beings have always depended on the forest ecosystem for survival. It 'has provided many of people's basic needs: shelter, fuel and water, food and protection for the crops' since time immemorial and 'contribute vital additional nutrients to the diets' (Dhali 2008: 229, 236). According to Shukla et al. (1990: 47) forests also serve as sources of 'economic, material technology, *medicinal needs* [emphasis added] and social and religious requirements.' Often communities tend to relate forests not only with their history, economy, status and civilization but also with preservation of cultures and traditions as they 'have acted as barriers to colonisation in all parts of the world' (Zon 1920: 140).

However as human beings began to increase their activities and alter lifestyles with passage of time – from simple to complex they *impacted* the environment – physical (land, air and water) biological (flora, fauna and microbial) and socio-cultural (society, economy and the politics); often guided by the capitalistic and anthropocentric approach to life. Today the negative impact of human activities on environment which is in turn causing negative impact on human existence has been felt, realized and accepted though quite hesitantly as some including the state are benefitting from unscrupulous exploitation of natural environment. Mercader (2003) traces the history of human activities and associates them with the rainforests [first activity of human must have taken place in rainforests because it provides rich diversity of flora and fauna that serve wo/man's needs] to more than forty millennia years ago. This human activity within the forests has introduced alteration in the forest ecosystem and over the years have been negative in nature.

The relationship between forest ecosystem and human life emphasising the aspect of health perhaps has quite clearly been articulated by Bisht (2002: 13) who states that life interplays with 'the external ecological setting that surrounds' us and create a complex 'matrix of physical, natural and social circumstances' which 'largely determine' not only the socio-economic aspects but also the 'health of an individual or a community at large.' According to Last (1993: 273 as cited in Patz et al. 2000) 'human interactions with each other as well as with other living creatures have important effects on the health of all partners in the complex closed ecosystem to our planet.'

### Global forestry

Forest area coverage of a region shows the relative importance that the forest has in a region (Global Forest

Resources Assessment 2005: p. 11). Figure 1 shows the forest coverage areas as generated by Global Forest Watch as used by World Conservation Monitoring Centre (WCMC) of a) Original as it appeared 8000 years ago, b) Current forest coverage (i.e., 1997 year) and c) the remaining Frontier Forest Coverage (Frontier Forests refers to forests where human interventions have

Figure 1: The maps show a) Original Forest Extent as it appeared 8,000 years ago b) Current Forest Extent and, c) Remaining Frontier Forest. Source: Global Forest Watch, (<http://www.globalforestwatch.org/english/index.html#>, retrieved on 15/12/2010).

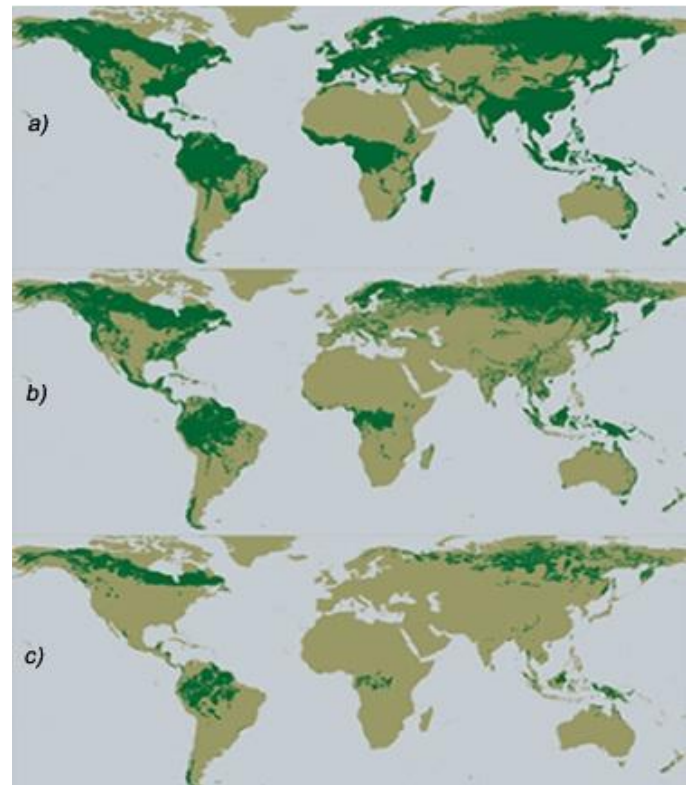
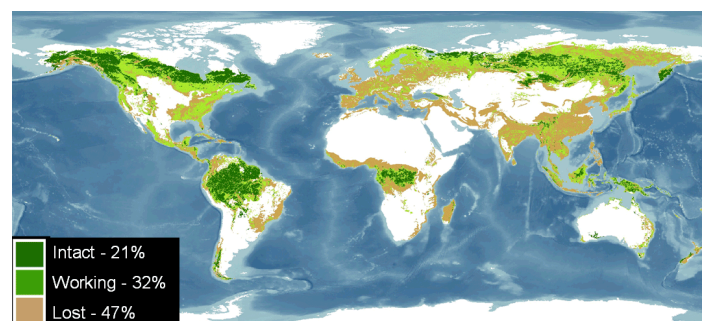


Figure 2: Map showing the status of present global forestry. Credit World Resources Institute. Source: <http://www.wri.org/map/state-worlds-forests>, (retrieved on 18<sup>th</sup> January 2011).



not taken place). From the maps it can be seen that there is a drastic difference in the area of forest coverage left on the earth from what it was at the beginning of human intervention till now (ibid: 13). Of the world's total area of 3454 million hectares of forest area which equals to

one-fourth of the total area of the world, 97 per cent are natural or semi-natural forests and 3 per cent is forest plantation, (FAO, No Date of Pub.). An estimate carried out in 1996 on frontier forest (virgin forest) area shows coverage of 21.7% at the global level and in the same year India had 1.3% of its total forest area as frontier forest coverage (Forest Grasslands and Drylands No Date of Pub.). And from Figure 2 it can be seen that the earth's 47 per cent of global forestry has already been lost and human activities are going on in 32 per cent thus leaving only 21 per cent as intact forestry.

While there is no agreement on the total global area of forest coverage before the beginning of human intervention the World Resource Institute (2007) gives the data as in Table 1, for the years 1990, 2000 and 2005 from where it is seen that developing regions and countries with low and middle income show decline and negative trend in the area of total forest coverage, while the developed countries and regions seem to have raised their total area of forest cover from 1990 to 2005.

pasturage... [and] the migration of the Aryans between 2000–800 BCE, and the advent of corn age' made forests 'vulnerable target' (ibid.1993: 69).

Kumar (2008: 299–300) taking clues from the ancient Indian Scriptures like the Vedas argues that 'principles of forest conservation and sustainable management were well entrenched in the pre-historic India' much before it 'originated in the Western Europe' thus attempting to show that India has a long history of life with forest. The argument thus supports the conclusion that people in India lived in forest areas even before the Vedic ages (1500 BCE to 500 BCE). Further Kumar paraphrasing Prime (2002) states that 'the Vedic traditions affirm that every village will be complete only when certain categories of forest vegetation or trees (e.g., Mahavan 'great natural forest', in modern days equivalent to 'protected forests', Shrivani ['forest of wealth', 'plantations', 'agroforests'], and Tapovan ['forest of religion']) are preserved in and around its territory.'

Though India had rich literature on forest and forestry,

reforestation, administration, preservation and regulatory laws concerning game ('Game Law' which was modified to Laws of Piety in 243 BCE (the 26<sup>th</sup> year of Ashoka's reign) it fell into slumber till it re-emerged after about 900 years later in the memoir of Hiuen Tsang who travelled to India during 629 A.D. to 645 A.D., and 'indicated the progress of dessication [sic] and deforestation in N.W. region, Kashmir and Punjab which was once densely forested according to Greek

historians accompanying Alexander' (Rawat 1993).

It is difficult to estimate the total forest coverage of ancient India- the reason could be perhaps, no one felt the need for documenting it since forests were in abundance. The World Resource Institute, Washington gives the data of forest extent in India for the year 1990, 2000 and 2005 as given in Table 2 where it can be seen that there is a decrease of 2490 thousand hectares of forest coverage from 1990 to 2005.

Table 1. Forests, Grasslands and Drylands -- Forest Extent: Total forest area. Adapted from: Food and Agriculture Organization of the United Nations (FAO). 2005. Global Forest Resources Assessment 2005: Progress towards sustainable forest management. FAO Forestry Paper 147. Rome: FAO. Source: <http://www.fao.org/forestry/foris/webview/forestry2/index.jsp?siteId=101&langId=1>.

Forests, Grasslands and Drylands -- Forest Extent: Total forest area				
Units: Thousand hectares				
Years	1990	2000	2005	Difference between 2005-1990
Region/Classification				
Asia (excluding Middle East)	547191	539016	544005	-3186
Central America & Caribbean	101993	95070	92612	-9381
Europe	989319	998090	1001393	12074
Middle East & North Africa	35289	36264	36562	1273
North America	608786	612432	613227	4441
Oceania	212504	208025	206245	-6259
South America	890818	852796	831540	-59278
Sub-Saharan Africa	691358	646887	626412	-64946
Developed Countries	1831288	1841453	1844756	13468
Developing Countries	2253337	2154965	2115123	-138214
High Income Countries	949722	957586	960392	10670
Low Income Countries	979419	910873	876733	-102686
Middle Income Countries	2148051	2120056	2114807	-33244

## Indian Forestry

Indian forestry has been a great resource for the nation. 'Geographical evidences of forestry during 350 to 225 million years ago show super abundant vegetation in India' (Ghosh 1993, paraphrasing Banerjee 1966). Destructive activities in the Indian forest are believed to have begun from Chalcolithic period (300–3500 BCE) onwards and the process of destruction was aggravated 'with invasion of people from Sumerian region... [who contributed] towards the settled cultivation and

Table 2: Natural Forest Area of India, adapted from World Resources Institute 2005 (Source: <http://www.wri.org>, retrieved on 15<sup>th</sup> January 2011).

<b>Forests, Grasslands and Drylands- Forest Extent: Natural forest area of India 2005</b>				
Units: Thousand hectares				
Year	1990	2000	2005	Difference between 2005-1990
Area	61985	64749	64475	2490

Table 3, below shows the forest extent and change by FAO (2009) for the year 1990, 2000 and 2005 by various regions of the world. Though the nature of change in some regions show positive trend the global trend is however negative at -0.22 per cent between 1990–2000 years and at -0.18 per cent during the 2000–

Table 3: Forest Extent and Change. Adapted from FAO 2009 as taken from FAO 2006a. (Data presented are subject to rounding).

Regions Area/Years	Area (1000 ha)			Annual Change (1000 ha)		Annual Change (%)	
	1990	2000	2005	1990-2000	2000-2005	1990-2000	2000-2005
Africa	699361	655613	635412	-4375	-4040	-0.64	-0.62
Asia and Pacific	743825	731077	734243	-1275	633	-0.22	0.09
Europe	989320	989091	1001394	877	661	0.09	0.07
Latin America and Caribbean	923807	882339	859925	-4147	-4483	-0.46	-0.51
North America	677801	677971	677464	17	-101	0	-0.01
Western and Central Asia	43176	43519	43588	34	14	0.08	0.03
<b>World</b>	<b>4077291</b>	<b>3988610</b>	<b>3952025</b>	<b>-8868</b>	<b>-7317</b>	<b>-0.22</b>	<b>-0.18</b>

2005 years. According to Patz et al. (2003: 122–23) ‘the status of the world’s forests is threatened by: conversion for crop production or pastures; road or dam building; timber extraction; and the encroachment of urban areas.’ Deforestation can take place due to human and natural causes. The human caused deforestation takes place through logging, forest clearance for cultivation, and construction purposes such as dams and houses, roads, or townships etc., while natural causes include floods, typhoon, and wild fire caused by lightning, and eruption of volcanoes. However overpopulation accompanied by more demand for food, space for living and other resources for sustaining life has caused the greatest harm to forest.

According to Sander (No Date of Pub.) ‘mining and logging industries have invaded the rainforest. Power now rests in money. These corporations use their power to destroy these valuable resources of the forests. The Rainforest Action Network has figured [sic] that corporate greed will consume the last remaining rainforests in less than 40 years.’

According to Shukla et al. (1990) increase in population and ‘demands on forest resources have... mounted because of forces of the economy in general’... causing ‘degradation of forest resources.’ It has also been found that ‘frontier colonialization, with its subsequent land use, has been the primary proximate cause of forest clearing’ (Carr 2008/09: 357). In India the causes of

deforestation can be related to rapid urbanization, rural-rural migration, and expansion of agricultural land post-independence, use of timber for construction of railway tracks both during the colonial as well as post-colonial periods and use of timber for

construction of houses and ships during the colonial periods. Today population growth accompanied by ever increasing demand for forest products is causing vast number of trees to be cut down for various purposes ranging from construction purposes to manufacturing of papers. Table 4, shows the deforestation data of India for the year 1999 and 2000 as provided by FAO (2003). As per the data there is a 0.1 per cent increase in forest coverage area in India between 1990–2000.

Table 4: Deforestation data of India by FAO. Source: [http://www.mongabay.com/deforestation\\_simple.htm](http://www.mongabay.com/deforestation_simple.htm), retrieved on 20<sup>th</sup> January 2011

Country	Land Area Total 1999 ('000 ha)	Forest Total 2000 ('000 ha)	Forest % of land area 2000 (% of land)	Forest Change 1990-2000 ('000 ha)	Forest Annual rate of change 1990-2000 (%)
India	2,97,319	64,113	21.6	38	0.1

## Deforestation and Ecological Imbalance

Ecology is the science of interrelationships of living organisms with each other and with their surroundings. It is a concept that studies how living organisms live in a state of equilibrium and balance, and fulfilment of each other needs. 'Healthy wild ecosystems clean the water we drink and produce the air we breathe, the foods we eat, the *medicines that cure and protect us*, [emphasis added] and the materials that form our shelter and clothing' (Roberson 2008: 3). Deforestation leads to destruction of forests which is the natural habitat for most living beings. Also human beings especially 'indigenous people get their food, their medicine, and their shelter from the forest' (Sander No Date of Pub). Deforestation creates ecological imbalance which causes nature to behave in an unpredictable manner, thus *impacting* life on earth. Deforestation also reduces the capacity of nature for absorption of Carbon Dioxide (CO<sub>2</sub>) from the atmosphere which in turn contributes towards the Green House Gas (GHG) effect thus leading to global warming and climate change. This problem of GHG effect is aggravated with ever increasing concentration of CO<sub>2</sub> in the environment from industries, vehicular movements and burning of biomass and is contributing to the phenomenon of Global Warming and Climate Change. According to Srivastava, (2007: 15) 'Global warming [besides having effects on biodiversity, weather pattern, sea level, life on land and in sea] will directly affect human health by increasing cases of *heat stress*' [italics as in original].

The world in recent past has witnessed this reality of unpredictability of nature in forms of storms, and extreme weather conditions. Human activities have been the main reason for 'resulting in phenomena that are changing out wild in unprecedented ways' (Longstreth 1991: 139). This is environmental related issue and since 'health conditions are an integral part of an environment' (Bisht 2002: 14) it affects us. Srivastava further states that 'climatic changes will have wide-ranging harmful effects including increase in heat-related mortality, dehydration, spread of infectious *diseases* [italics as in original], malnutrition, and damage to *public health* [emphasis added] infrastructure.' Because of deforestation 'many plants and animals that live in rain forests are facing the spectre of extinction' (Innes, 1996).

## Deforestation and depletion of Herbal Medicinal Plants

Deforestation is understood as loss of trees and vegetation and has been related to negative effects on 'biodiversity, environment and social setting' (Fiset 2007). Deforestation leads to 'climate change', 'abrupt change in temperatures in the nearby areas', lowering of

'water table' and 'drying up of wells' due to surface run off, it also leads to 'destruction of natural habitats to many types of animals and organisms' and it is 'hardly [*sic*] hitting the living conditions of indigenous people who consider forests as their primary habitats' (ibid: front page). The 'earth is losing at least one potential major drug every two years' due to habitat destruction (World Atlas of Biodiversity 1995 in Roberson 2008).

Since ancient time people have been depending on forests for health care. According to Arrowsmith (2009: 21) human knowledge on herbal medicine developed through intuition as in the case of animals, then it was supplemented by 'empirical observation and experimentation' of 'how different animals reacted to herbs' and through test of 'each of plant' and careful observation 'for specific characteristics.' This knowledge was then handed down to next generation which continues even today.

Deforestation means destruction of plants including medicinal plants. According to Innes (1996) 'preserving the rainforest would leave many opportunities in *medicine* [emphasis added] and many other fields open for future generations to explore and further advance humanity.' Shanley and Luz (2003: 573 paraphrasing Caniago and Siebert 1998 and Cunningham 2000) states that besides deforestation 'new land-use regimes place increasing pressure on many native medicinal plant species.' Forest transformation through fire, selective logging, ranching, and shifting agriculture causes 'changes in forest composition and structure' thus affecting the 'availability of medicinal plant products as well as other economic plant species' (ibid: 578).

It is estimated that 'between 50,000 to 80,000 flowering plants are used medicinally' (Roberson 2008 paraphrasing IUC Species Survival Commission 2007 and Marinelli 2005) and diversified flora provides more opportunity for practice of 'herbal medicine' according to Shukla et al. (1990: 107).

A recent survey on medicinal resources 'showed that of the top 150 prescription drugs used in the United States, 118 are based on natural sources: 74% on plants, 18% on fungi, 5% on bacteria, and 3% on one vertebrate (snake) species. Nine of the top ten drugs in this list are based on natural plant products' (Grifo and Rosenthal, in press, as cited in Dobson 1995, as paraphrased by Ecological Society of America 1997: 6).

The findings in the following literature emphasise the importance of medicinal plants in health care:

1. According to Alcorn (1995) in Begossi et al. (2002: 281) 'about 80% of people in the world rely on folk, or traditional medicine.'



2. WHO (No Date of Pub.) in Farnsworth et al. (1985) in Carlson (2003) states that traditional medicines in the form of plants constituted more than 80 per cent in the area of global primary health care.
3. Adjemian (2008) paraphrasing Cunningham (1993) and Stanley (2004) says 'seventy to eighty per cent of Africa's population uses traditional medicine, predominantly plants rather than modern medicine' due to 'unfeasible option' for accessing 'modern medicines.'
4. According to Colfer et al. (2006: 4) people living in and around forest areas have to depend on herbal medicines because they are generally 'disregarded in formal health care systems and research' due to remoteness which cause 'difficulty [in] attracting doctors, nurses and health system administrators.'

The value of the role of medicinal plants serving as the primary source of healthcare for the majority of the developing world's population has been clearly stated by the World Health organization (2003). Vieira (1991) as cited by Shanley and Luz (2003: 576) found some plants being used to 'treat diseases for which pharmaceutical medications do not yet exist.'

The Indian forests with all their wide diversity harbour 90 per cent of India's medicinal plants and about 10 per cent of other medicinal plants are from 'non-forest

habitats' thus making India as a state to have 'one of the richest plant medical traditions in the world'; and deforestation thus endangers the 'estimated... 25,000 effective plant-based formulations, used in folk medicine and known to rural communities' (Wakdikar 2004: 217).

Herbal medicinal plants besides serving as 'source of alternative medicine' also serve an important role in manufacturing of modern medicine as '*a significant number of modern pharmaceutical drugs*' [emphasis added] companies use herbal medicinal plants for manufacture of drugs (ibid: 218) and in India 'almost 70 per cent of modern medicines'... 'are derived from natural products' (ibid: 218, citing Choudhary 2002).

A publication under the title The Holocaust of the Green Cathedral (No Date of Pub.) lists the following medical benefits of tropical forest plants are:

- Forest Indians of Northwest Amazonia use over 1,300 plant species as medicines.
- Worldwide over 3,000 different species are used by indigenous peoples to control fertility.
- 120 pure chemical substances used in medicine are derived from less than 90 higher plant species. Less than 1% of 250,000

known tropical rainforest plants have been screened for use in life-saving drugs. 40% of the world's drugs come from the wild. The trade is worth \$40 billion per year worldwide.

- Diosgenin from the wild yam *Dioscoria* sp. from Mexico and Guatemala enabled the contraceptive pill to be developed. In China and India, wild yams are still processed to make oral contraceptives.
- Tubocurarine made from curare from the Amazonian liana *Chondodendron tomentosum* is used as a muscle relaxant during surgery.
- Industry Tropical forests produce far more than timber: Rubber, Gum, Latexes, Resins, Tannins, Steroids, Waxes, Rattans, Bamboo, Essential and edible oils, Pesticides, Nuts and fruits, Lubricants, Flavorings and dyestuffs.

Table 5 shows the number of plant species used as medicines in various countries as available with Food and Agricultural Organization (FAO). There are 422000 plant species in the world of which 52885 species are of medicinal value. In China of 26092 native species 4941 (i.e. 18.9 per cent) are used as medicine while in India out of 15000 native species 3000 (i.e. 20 percent or one fifth) are used as medicinal plants. The data of other countries can be seen from Table 5.\

Thus deforestation and reduction of forest coverage area due to human activities has put these medicinal plants into great danger. A study carried out by Royal Botanic Gardens as carried in Science News and KEW (September 29<sup>th</sup> 2010) under the title '*More Than One-Fifth...*' reveals the following findings:

**Table 5: Number of Plant Species used as Medicines**

Country	Plant Species [Native]	Medicinal Plant Species	Percentage [in health care]
China	26092	4941	18.9
India	15000	3000	20
Indonesia	22500	1000	4.4
Malaysia	15500	1200	7.7
Nepal	6973	700	10
Pakistan	4950	300	6.1
Philippines	8931	850	9.5
Sri Lanka	3314	550	16.6
Thailand	11625	1800	15.5
USA	21641	2564	11.8
Viet Nam	10500	1800	17.1
Average	13366	1700	12.5
World*	422000	52885	

*Number of Plant Species used as Medicines. Source: FAO, (no date of publication) as adapted from Duke and Ayensu (1985); Govaerts (2001); Groombridge and Jenkins (1994, 2002); Jain and DeFillipps (1991); Moerman (1996); Padua et al. (1999)*

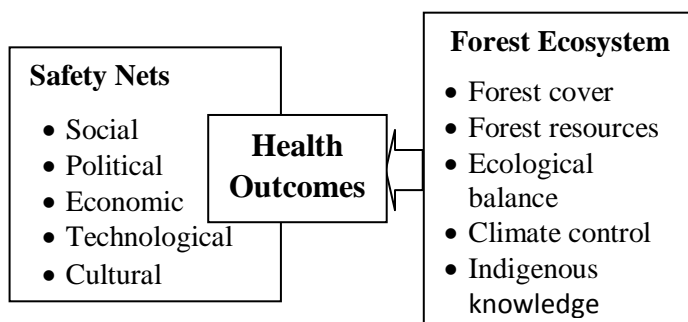
<http://www.fao.org/docrep/005/y4586e/y4586e08.htm#TopOfPage>.

\* Shows the plant species at the global level and not total of the countries above.

- About one third of the species (33%) in the sample are insufficiently known to carry out a conservation assessment. This demonstrates the scale of the task facing botanists and conservation scientists -- many plants are so poorly known that we still don't know if they are endangered or not.
- Of almost 4,000 species that have been carefully assessed, over one fifth (22%) are classed as Threatened.
- Plants are more threatened than birds, as threatened as mammals and less threatened than amphibians or corals.
- Gymnosperms (the plant group including conifers and cycads) are the most threatened group.
- The most threatened habitat is tropical rain forest.
- Most threatened plant species are found in the tropics.
- The most threatening process is man-induced habitat loss, mostly the conversion of natural habitats for agriculture or livestock use.

Thus the possibility losing some of the medicinal plants forever is not low, because if not all, some of those 22 per cent (i.e. one fifth) of the species that are endangered surely have medicinal properties. And the most important factor that is contributing towards this is the human activity. In Eastern Amazonia according to Shanley and Luz (2003: 577, 579) over-harvesting and use of 'destructive harvesting techniques' deforestation has caused decrease in the availability of some medicinal roots, barks and oils.

#### Conceptual framework of linkages between Health Outcomes, Safety Nets and Forest Ecosystem



#### Safety nets

Safety nets are those services or insulating layers that safeguard an individual or the population against adverse effects of unforeseen circumstances. With regard to health outcomes safety nets could be broadly categorised into social, political, economic, technological and cultural.

**Social:** *Insurance, health care policies and programmes, housing programmes, food and nutrition security policies and programmes.*

**Political:** *Political will for ensuring the social, economic, technological and cultural*

*aspects for promotion of health and well-being.*

**Economic:** *Micro and Macro Economic policies – Drug policies, import and export policies, insurance policies, health budgeting and financing.*

**Technological:** *Application of science and technology in the areas of promotion and safeguarding health of people.*

**Cultural:** *Learnt and acceptable health behaviours and practices.*

#### Forest Ecosystem

Forest ecosystem carries along with it the elements of forest covers, and forests resources along with all other organisms that depend on it and contribute towards its sustenance. The state of harmonious relationship and dynamic equilibrium between different components (biotic and abiotic) in the environment is known as ecological balance. The structural change in the forest ecosystem caused by deforestation and forest degradation brings about –

- *Reduction in forest cover area*
- *Reduction availability of forest resources*
- *Create ecological imbalance*
- *Contribute towards global warming and climate change and*
- *Bring about degeneration of indigenous knowledge and practices.*

#### Health Outcomes

*A positive health outcome arising out of the interaction between various factors in the natural environment where the individual lives.*

#### Finding of the Study

- About 70 – 80 per cent of global population depend on 'folk or traditional medicine' for health care.
- About 90 per cent of Indian traditional medicines are forest based.
- In India almost 70 per cent of modern medicines are derived from natural products.
- A significant number of modern pharmaceutical drug companies use herbal medicinal plants for manufacture of drugs.
- 40 per cent of the world's drugs come from the wild.
- 120 pure chemical substances used in medicine are derived from less than 90 higher plant species.
- The most threatened forests are the tropical forests which also houses most of the medicinal plants.
- Health hazards such as- headache, fever and leg injuries have been reported by women folk who have to carry firewood from greater distances on head due to deforestation. This is an important correlation since women are primary role players in collecting firewood, and managing all that is related to kitchen.
- The greatest threat to medicinal plants comes from human activities.

## Concluding remarks

There is an undeniable relationship between forest ecosystem and human health as forest ecosystem degeneration has not caused only loss of wild life but also medicinal plants, food and nutrition from the ecosystem and loss of indigenous health knowledge. To reduce and resolve this concern human need to change the capitalistic and anthropocentric approach to development. While there is no denial on the relationship between degradation of forest ecosystem and health effects it is to some extent difficult to establish a clear statistical relationship between the two. There is a need therefore of a development and application of a methodology which will be able to capture this relationship.

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